

inputs configured to receive requests for connecting input ports to output ports;

an arbitration circuit configured to arbitrate between the input ports for connections to the output ports, the arbitration circuit selecting the input ports for a next time slot according to both a priority and weight of packets at the input ports.

3. A scheduler according to claim 2 including timers that are activated anytime one of the input ports requests a connection to one of the output ports, the arbitration circuit increasing the priority for any input ports having unserved connection requests extending beyond a timer period.

25 4. A scheduler according to claim 1 wherein the arbitration circuit
conducts output port arbitrations for each one of the output ports and conducts input
port arbitrations for each one of the input ports winning multiple output port
arbitrations.

30 5. A scheduler according to claim 4 wherein the output port arbitrations
and the input port arbitrations are conducted for both multicast packets and unicast
packets for a next time slot.

6. A scheduler according to claim 1 wherein each one of the input ports
35 has associated virtual output queues each dedicated to a different one of the output
ports.

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receiving requests from input port buffers for connections to the output ports during a next time slot;

identifying arbitration parameters for the requests;

conducting output port arbitrations for each one of the output ports according to the arbitration parameters;

10 issuing grants to the input port buffers winning the output port arbitrations;

conducting input port arbitrations for input ports receiving grants from the output port arbitrations;

accepting one of the grants to one of the input port buffers at each input port winning the input port arbitrations; and

15 connecting the input port buffers accepting the grants to the requested output
ports.

15. A method according to claim 14 wherein the arbitration parameters include a weight that varies according to a number of packet bytes in the input port buffers and a priority of the packets in the input port buffers.

16. A method according to claim 15 including:

selecting one of the weight and the priority to identify a first highest arbitration status;

25 using the other nonselected weight and priority to identify a second highest arbitration status for two or more input port buffers having the same first highest arbitration status; and

issuing grants to the input port buffers according to the first highest arbitration status when packet for only one input port buffer has the first highest arbitration status and issuing grants to the input port buffers according to the second highest arbitration status when two or more input port buffers have the first highest arbitration status.

17. A method according to claim 16 including using a round robin arbitration

35 when two or more input port buffers have the same first highest arbitration status and
the same second highest arbitration status.

18. A method according to claim 17 including tracking how long the input

5 port buffers have waited for connections to the output ports and increasing priority for
input port buffers that have waited beyond a given threshold time period.

19. A method according to claim 14 including:
conducting a multicast arbitration for multicast packets in the input port
10 buffers;
and
granting one of the input port buffers winning the multicast arbitration all
output
port identified in an associated multicast group vector.

20. A method according to claim 19 including:
identifying multicast group vectors for the multicast packets;
conducting multicast input port arbitrations for identifying a highest one of the
multicast group vectors for each one of the input ports;
conducting multicast output port arbitrations using the highest multicast group
vectors for the input ports; and
establishing connections for the multicast group vector winning the multicast
output port arbitrations.

25 21. A method according to claim 20 including:
 comparing grants issued from the output port arbitrations with the multicast
 group vectors; and
 accepting the grants matching the multicast group vector.

30 22. A method according to claim 19 including conducting a unicast arbitration after the multicast arbitration.

23. A method according to claim 19 including varying a percentage of
output ports that can be assigned during the multicast arbitration before conducting
35 the unicast arbitration.

24. A method according to claim 14 including dedicating one input port buffer in each input port to one of the output ports and using the input port buffers at

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5 virtual output buffers for temporarily storing packets assigned to the dedicated output
ports.

25. A method according to claim 14 including conducting a first round robin arbitration when multiple packets have the same highest priority and same weight during the output port arbitrations and conducting a second round robin arbitration during the input port arbitrations when multiple input port buffers for the same input ports have been issued grants during the output port arbitration and have the same highest priority and same weight.

15 26. A network processing device, comprising:
multiple input ports for receiving incoming packets;
multiple output ports for outputting packets;
a cross switch coupled to the different input ports and the different output
ports;
20 a scheduler that configures the cross switch for connecting selected ones of the
input ports to selected ones of the output ports; and
multiple virtual output buffers associated with each one of the input ports,
each one of the virtual output buffers dedicated to a different one of the output ports.

25 27. A network processing device according to claim 26 wherein the scheduler conducts a multicast arbitration before each time slot to select virtual output buffers to connect to multiple output ports, the scheduler then conducting a unicast arbitration for connecting any unselected virtual output buffers to unselected output ports.

28. A network processing device according to claim 27 wherein the scheduler conducts the multicast arbitration and the unicast arbitration both for the virtual output queues associated with the same input ports and for the virtual output queues dedicated assigned to the same output ports.

29. A network processing device according to claim 28 wherein the multicast arbitration and the unicast arbitration;
issue grants according to priority of the packets in the virtual output queues;

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